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301-227-1834
West Bethesda, MD

SEAL COMPRESSION INDICATION SYSTEM

STATEMENT OF GOVERNMENT INTEREST

[0001] The invention described herein may be manufactured and used by
or for the Government of the United States of America for governmental
purposes without payment of any royalties thereon or therefore.

12 BACKGROUND OF THE INVENTION

13 [0002] The integrity of seals is often a critical element in the operation of
14 various items. Nowhere is this truer than in doors, especially watertight
15 doors, on ships. Watertight doors and hatches are critical to controlling
16 flooding on ships and submarines. These doors often handle large
17 amounts of traffic, cycling the doors open and shut several thousand
18 times a week, causing the seal integrity to fade. Such doors often require
19 extensive adjustments and maintenance in order to maintain a fluid tight
20 closure. The twisting and flexing that occurs on ships cause doors to
21 warp or bend resulting in loss of seal integrity. Other than periodic spot
22 checks, there is currently no way to check the seal integrity on a
23 continuous basis.

24 [0003] The current way to check seal integrity of watertight doors is to
25 perform a chalk test. The chalk test is a simple means of determining if
26 the gasket is in continuous contact with the knife-edge of the doorframe
27 when the door is closed. Chalk is rubbed on the knife-edge of the
28 doorframe and the door is shut and dogged tight. The door is then
29 opened and the chalk line on the seal should be continuous if the door is
30 adjusted properly. A non-continuous chalk line on the gasket indicates
31 that the dogs are not pressing the gasket against the knife-edge
32 properly. However, the chalk test does not guarantee that the door is
33 watertight, as it does not measure seal compression.

34 [0004] Chalk tests are preformed on a periodic basis as it is a labor-
35 intensive test. Doors and doorframes, especially the knife-edges, are
36 subject to wear and tear with repeated use. Additionally, the frames and
37 surrounding structures are often subject to stresses that may warp or
38 bend the frames or surrounding structure. This may mean that even

39 though the chalk test was successful, subsequent damage to the door or
40 frame might occur that causes a bad fit that will not be discovered until
41 the next chalk test.

42 [0005] Another method used to check seal integrity uses acoustic
43 transducers. In this test, transducers are placed on one side of a closed
44 door to produce acoustic energy and the quality of the seal is surmised
45 based on the amount of acoustic energy received. However, such a
46 method is labor intensive and does not provide continuous feedback.

47 [0006] What is needed is an apparatus that can quickly and continuously
48 determine if the seal is engaged adequately on a closed door.

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49 SUMMARY OF THE INVENTION

50 [0007] In the present invention there is provided a watertight door seal
51 compression indication apparatus that includes a watertight door in a
52 frame that has a gasket disposed in a channel around the periphery of
53 the door. A knife-edge on the doorframe is positioned to compress the
54 gasket upon latching the door shut. A plurality of switches are placed
55 between the channel and the gasket and the switches are closed when
56 the knife-edge edge fully compresses the gasket. A display that is
57 responsive to the switches indicates whether the gasket was sufficiently
58 compressed or not.

59 [0008] In accordance with the invention there is provided a new door seal
60 indication system for indicating the seal compression status of a
61 watertight door on a ship. The system includes a display assembly for
62 indicating the status of the compression of a seal in a door that may be
63 determined by the level of a number of electrically coupled switches that
64 are disposed under the seal and actuate by compression of the seal upon
65 the door closing sufficiently tight. Actuation of all of the switches causes
66 the display assembly to indicate the door is closed properly.

67 [0009] In accordance with another example of the present invention an
68 indication device for displaying the seal compression status of a
69 watertight door seal is provided. The actuation of switches in response
70 to the door shutting indicates a proper seal and any switches not fully
71 actuated upon door closure indicate a faulty seal. The device includes a
72 plurality of switches wired in series disposed under a door seal, and the
73 switches have two states: an open state and a closed state. A display
74 assembly responsive to each of the switch states provides an easy visual
75 key to the status of the seal compression.

76 [00010] Optionally, in the door seal indication system the switches are
77 located at each latching point or dog of the door. In another example,
78 the system display assembly includes a battery and two LEDs to indicate
79 the status. Optionally, the display assembly includes two lights and a
80 power source such as the ship power grid.

81 [00011] For a better understanding of the present invention, together with
82 other and further objects thereof, reference is made to the following
83 description, taken in conjunction with the accompanying drawings, and
84 its scope will be pointed out in the appended claims.

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85 **BRIEF DESCRIPTION OF THE DRAWINGS**

86 [00012] FIG. 1 is a front elevation view of an example shipboard watertight
87 door and doorframe assembly.

88 [00013] FIG. 2 is an enlarged partial cross sectional view of the
89 switch/gasket in accordance with the present invention.

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DESCRIPTION OF THE PREFERRED EMBODIMENT

[00014] Referring now to the example of Figure 1, a typical shipboard watertight closure is shown. The watertight closure includes a movable door 10 that is attached to the bulkhead 26 by a doorframe 24. The door 10 includes a latching mechanism that includes a door latching handle 14 and numerous dogs 12 that operate through linkages 13 to latch the door 10. The display assembly 20 with indicator lights 22 may be mounted to the face of the door 10.

[00015] Figure 2 is an example of an enlarged partial cross sectional view of the door 10, switch 18 and gasket 16 in accordance with the present invention. When the door 10 is latched the knife-edge 28 of the doorframe 24 compresses the gasket 16 in the channel 35 on the door 10 to form a seal. In an example of the present invention a switch 18 is placed under the gasket 16 at each dog 12 location to indicate when the door is latched or dogged shut properly. The switches 18 may be simple membrane switches though other types of two state switching devices may be easily substituted. The switches 18 are sized to electrically close once the gasket 16 is compressed to a sufficient height by the dogs 12. The approximate minimum depth of compression for a watertight seal is 1/16 inch. Preferably, the gasket 16 may be compressed approximately 1/8 inch. The switches 18 are wired in series and the output of the switches will be wired to indicator lights 22 in an easily visible area of the door 10.

[00016] In operation, with a properly adjusted door 10 and dogs 12, if the door 10 is latched closed then the gasket 16 is compressed sufficiently so that all the switches 18 are activated and the circuit completed along transmission wire 30 to the display box 20 as shown in Figure 1 to light

117 the green LED 22. If the door is not latched properly because it is out of
118 alignment or damaged causing at least one switch 18 to be inactivate,
119 then the red LED 22 will be lit.

120 [00017] The transmission wire 30 in a preferred example runs from the
121 display assembly 20, in series between the switches 18 under the gasket
122 16 and through notches in the gasket retainer 34. The transmission wire
123 30 then passes through a small hole 32 in the gasket frame and back to
124 the display assembly 20. The display assembly box 20 is preferably
125 mounted on the face of the door 10 though other locations near the door
126 10 would also be suitable. The display box 20 preferably houses a
127 battery (not shown) that provides the power for the indicator lights 22
128 and switch circuits. It would also be possible to supply power from the
129 ship's power plant. Additionally, the invention could be adapted to
130 interface with the damage control systems on a ship so that any
131 watertight door that is open or not sealing properly would be displayed to
132 ships personnel for action.

133 [00018] While there have been described what are believed to be the
134 preferred embodiments of the present invention, those skilled in the art
135 will recognize that other and further changes and modifications may be
136 made thereto without departing from the spirit of the invention, and it is
137 intended to claim all such changes and modifications that fall within the
138 true scope of the invention.

139 [00019] What is claimed is:
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